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CAPRIFIGS AND CAPRIFICATION

BY
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CAPRIFIGS AND CAPRIFICATION

By I. J. CONDIT

For many centuries there has been grown in a small valley of Asia Minor a type of fig known as the Smyrna, so called from the seaport where the figs are packed and shipped. The superior quality of these dried Smyrna figs is recognized in all markets to which they have been shipped and other fig-growing countries have long striven to produce the same quality in their own fig product. It was known that the native growers of Smyrna made a practice in the spring of the year of suspending wild figs or caprifigs, in the Smyrna trees. From these capri figs there issued hundreds of small insects or wasps known scientifically as *Blastophaga grossorum*, which entered the eye of the Smyrna fig, causing the fruit to set. In case this operation was neglected, or if caprifigs were unobtainable, the small Smyrna figs soon turned yellow and dropped off, causing a crop failure. The process of distributing caprifigs among the branches of the Smyrna fig tree, thus insuring the setting of the fruit of the latter, is known as caprification. Although caprification was known by the native growers to be absolutely necessary to crop production, they did not understand the principles underlying the process or the real causes either for the setting or the dropping of the Smyrna fruit. European investigators have studied the process and published many articles about it, but it is only since the introduction of the true Smyrna fig into California and the establishment of the fig wasp that the necessity for a thorough knowledge of its practical aspects has been appreciated. On account of the very rapid growth of the fig industry in California and the recent large plantings of Smyrna figs, there is a keen demand for practical information about varieties of caprifigs, cost of caprification, and methods of distributing the figs in the orchard. It is the purpose of this publication to present the latest and most reliable information on the points just mentioned, as well as on others which may be of prime importance to the fig grower.

HISTORICAL SKETCH

The early history of caprification has been so thoroughly reviewed by other writers¹ that it is not necessary to give a detailed account here. Some of the modern developments, however, have a practical significance and these will be briefly reviewed.

Cuttings of the true Smyrna fig were imported into California in 1881–82 by G. P. Rixford, at that time of the Bulletin Company, San Francisco. Among the cuttings there were also a number of cuttings of caprifigs which were known to be necessary to the production of the edible figs. On account of the financial and practical interests of Governor Leland Stanford in the importation, a considerable number of both the Smyrna figs and caprifigs were planted on his ranch at Vina. Large trees of both types are still growing on the place, although unfortunately many fine specimens have disappeared. The trees have furnished the source of supply for thousands of cuttings distributed by the Department of Agriculture, among them being more or less promising varieties, such as the Stanford Smyrna fig and the Stanford caprifig.

While engaged in the nursery business at Corning, W. H. Samson propagated fig trees extensively with cuttings obtained from the Stanford Ranch. Since the trees were growing mostly in a row along an irrigation ditch, Mr. Samson numbered the trees from which cuttings were taken as 1, 3, 5, and 21, according to their position in the row. Nursery trees were sold and shipped under these numbers to fig growers throughout the state, although orchards from this source are now most common at Merced and Corning.

The Smyrna fig orchards of the San Joaquin Valley are made up mostly of varieties introduced by G. C. Roeding, Fresno. The first introduction was made in 1888 and eventually an orchard of sixty acres was planted. On account of the lack of caprifigs containing insects this orchard was maintained at a loss for several years, the first commercial crop being harvested in 1900 following the successful establishment of the fig wasp the previous year. Three varieties of caprifig imported by Mr. Roeding were numbered 1, 2, and 3 before their seasons of fruiting were known. No. 3 has since proved to be the earliest and No. 2 the latest in ripening. Mr. Roeding has also

¹ Readers who desire to obtain references on caprification should consult Bulletin 9, Division of Pomology, United States Department of Agriculture, by Gustav Eisen, and United States Department of Agriculture Bulletin 732 (*same*), by G. P. Rixford.

introduced the Magnissalis, the Howard, and other varieties of caprifig as well as the Calimyrna, the variety of Smyrna fig which is being planted almost exclusively at the present time.

The early literature on the fig in California abounds in articles discussing the necessity for caprification and the identity of the true Smyrna fig. In an attempt to prove these points E. W. Maslin obtained some seeds of the imported Smyrna fig from San Francisco and later from New York, raised seedlings and planted them in orchard form at Loomis in 1887. The fruit appearing on the seedlings all dropped on account of lack of caprification until the fig wasp was established at Loomis in 1901. It was then found that of the 139 seedling trees 74 were caprifig and 65 Smyrna fig trees. The orchard was leased by Mr. Roeding during the seasons from 1905 to 1907, inclusive, and by the late Henry Markarian of Fresno for the season following. Because it was so difficult for the growers to get an adequate supply of caprifigs for their trees, the Maslin seedling fig orchard at Loomis was leased by the Department of Agriculture on November 1, 1908, since which time caprifigs have been widely distributed in small quantities free and in large quantities at cost. Cuttings of the best varieties have also been sent out to applicants, and seedling figs have been grown in large numbers for trial by interested growers. Such distributions have been in charge of G. P. Rixford, San Francisco, for the United States Department of Agriculture. The seedling caprifig trees in the Maslin orchard have been numbered according to their position, the following being worthy of note: No. 70 or Bleasdale, No. 144 or Mason, No. 147 or Loomis, No. 148 or Newcastle.

THE FIG FRUIT AND ITS STRUCTURE

The fruit of the fig tree consists of a hollow receptacle on the inner lining of which the flowers are borne. The first crop of fruit pushes out on the wood of the previous season at the same time that leaves are appearing on the new growth of the current year. The small buttons or buds which are more or less apparent during the winter simply enlarge and continue growth throughout the spring months, developing into mature fruits commonly known as "brebas," in May, June, or July, depending upon the rapidity of growth. The second crop of figs appears on the new wood in the axils of the leaves and matures during the summer and fall months. All figs have at the apex a more or less distinct opening or eye leading into the interior. The neck of the eye is lined with scales which either remain closely appressed as the fig matures or spread apart and leave the eye open.

The edible part of the mature fig consists of the fleshy meat of the receptacle and the pulpy mass which develops around the flowers during the process of growth.

Flowers.—There are three kinds of flowers found in figs: the pistillate or female flowers, the staminate or male flowers, and the gall flowers. These, as a rule, are not all found in any one fig but are mostly characteristic of the fruit borne by certain classes of figs.

The female flowers are practically the only kind borne within the receptacle of edible figs. The individual flower consists of either a simple or a forked stigma, a long slender style, and a one-celled ovary. It can be stated in a general way that practically all female flowers are capable of pollination and fertilization, processes which may or may not be necessary to the setting of fruit, as will be explained later.

The male flowers are borne almost exclusively within the receptacle and near the eye of the caprifig, which is therefore commonly known as the male fig. In many varieties individual stamens are found among the other flowers of the caprifig. The male flowers are numerous in the spring crop of the caprifig tree and lacking, or nearly so, in the fall and winter crops. One species of fig known as *Ficus pseudocarica* bears stamens in the figs of all crops produced by the tree.

The stamens consist of a filament or stalk which varies in length according to position, and of three to six anthers borne at the top of the filament, each anther being supported by a short pedicel. The yellow pollen is shed in quantity by the anthers at the time the fig matures and the insects are ready to emerge. The number of stamens and the amount of pollen produced vary somewhat in different varieties of caprifigs and are an indication of the value of a variety.

The gall flowers are modified female flowers which have become adapted to the needs of the fig insect. The flower consists of an ovary, a style, and stigma as in the female flower, but the style is short, stubby, and hollow, instead of long and slender, and the stigma is rather broad and flattened. They are borne principally in the lower half of the receptacle of the caprifig. The color of the style and the adjoining part of the receptacle varies in different kinds of caprifigs. Some maintain a yellowish-white color throughout; others are white until the flowers are stimulated by the egg-laying of the fig wasp, when they assume a violet or purple tint very pronounced in some specimens. That the gall flowers are modified female flowers is shown by the fact that they will mature fertile seeds if caprifigged and the eggs of the insects fail to develop inside the ovaries.

CLASSES OF FIGS

Figs are generally classified on the basis of the kind of flowers borne within the receptacle and upon the necessity for caprification. For all practical purposes the recognition of four classes is sufficient. These are Caprifigs, common figs, San Pedro figs, and Smyrna figs.

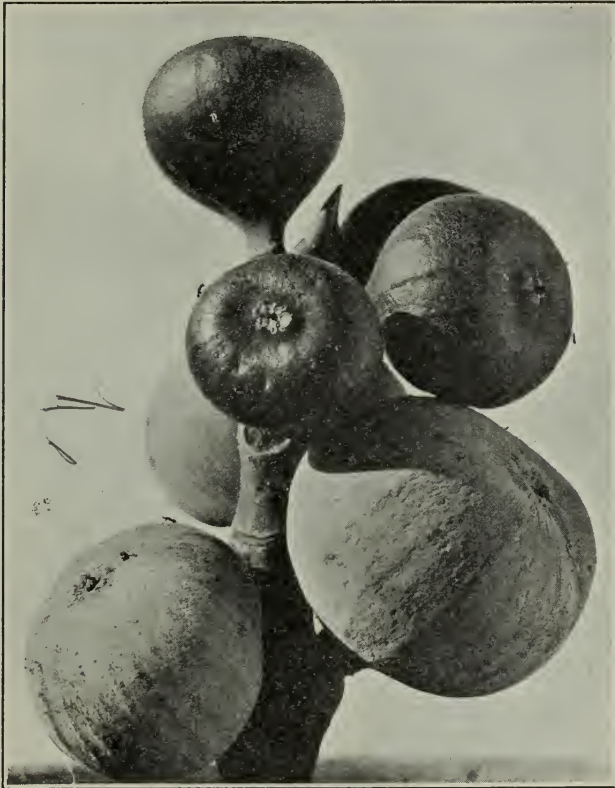


Fig. 1.—The largest figs in the illustration are mamme figs from which the *Blastophagas* are issuing. The four smaller figs at the tip of the branch are profichi figs of sufficient size for the female insects to enter and oviposit. Note the female *Blastophagas* on the surface of the fruit.

Caprifigs.—The caprifig is the native or wild goat fig of southwestern Asia and southeastern Europe. The gall flowers of the receptacle serve as the home or place of development of the larvae of the fig wasp in all crops of the tree. The caprifigs are mostly inedible on account of the presence of the insects and the mass of dry male flowers near the eye. A few varieties of edible caprifigs

or figs bearing short-styled flowers are found, notably Pingo de Mel grown commercially in the Coachella Valley. The Cordelia fig described by Gustav Eisen probably belongs here.

The caprifigs can readily be distinguished from the common or Smyrna figs by the short-styled flowers of the former.

Common figs.—This class of figs is so called from the fact that most of the innumerable varieties of figs grown in Europe and America belong to it. The female flowers have a long slender style but do not require the stimulus of pollination and fertilization to make



Fig. 2.—Stanford Capri tree, Bowen Place, Ceres, June 11, 1919. The Stanford caprifig tree is an unusually vigorous grower.

the fruit set. The development of the fruit is somewhat analogous to that of the navel orange, many oriental persimmons, and the seedless grape, the flowers usually being unpollinated and the fruits seedless. Most of the common figs develop seeds which are mere hollow shells without a kernel. Some are almost seedless.

Caprification of the common figs is possible but not necessary to fruit development. It has been fully demonstrated that most varieties of common figs can be caprifigged and made to produce an abundance of fertile seeds. The practical importance of this matter will be discussed later.

The Mission, Adriatic, Black San Pedro, Dottato (Kadota), Brown Turkey, Brunswick, and numerous other varieties belong to this class.

Smyrna figs.—The female flowers of *Smyrna* figs have long slender styles very similar to those of the common figs. The flowers, however, require the stimulus of pollination and the resulting fertilization of the ovary in order to make the fruit set. Without this stimulation the fruits soon turn yellow and drop. It is the oily kernel of the fertile seed which gives the fresh and especially the dried *Smyrna*



Fig. 3.—The Milco caprifig tree is as certain as any other variety to carry the mamme or winter crop safely. The mamme figs are large and conspicuous on the leafless branches during the dormant season.

figs their superior quality. The essential differences between the common and *Smyrna* fig in the necessity for caprification, have not been determined.

The *Calimyrna*, *Lob Injir*, *Bardajic*, *Kassaba*, and *Rixford* are varieties of the *Smyrna* class.

San Pedro figs.—The figs of this class are peculiar in that the flowers produced in the fruit of the first crop differ from those of the second crop. The nature of the flowers produced by the first-crop figs is similar to that of the common figs and the fruit matures without the necessity of caprification. The flowers produced by figs of the second crop are similar in nature to those of *Smyrna* figs, requiring the stimulus of caprification in order to set fruit.

The White San Pedro fig is grown commercially in the Coachella Valley, principally for the large, first-crop figs produced. The Gentile fig also belongs to this class.

Why figs drop.—We may now understand the reasons for the dropping of figs. Figs which drop may be of the Smyrna class, the fruits of which require caprification in order to set and remain on the tree; they may be of the caprifig class, the fruits of which drop

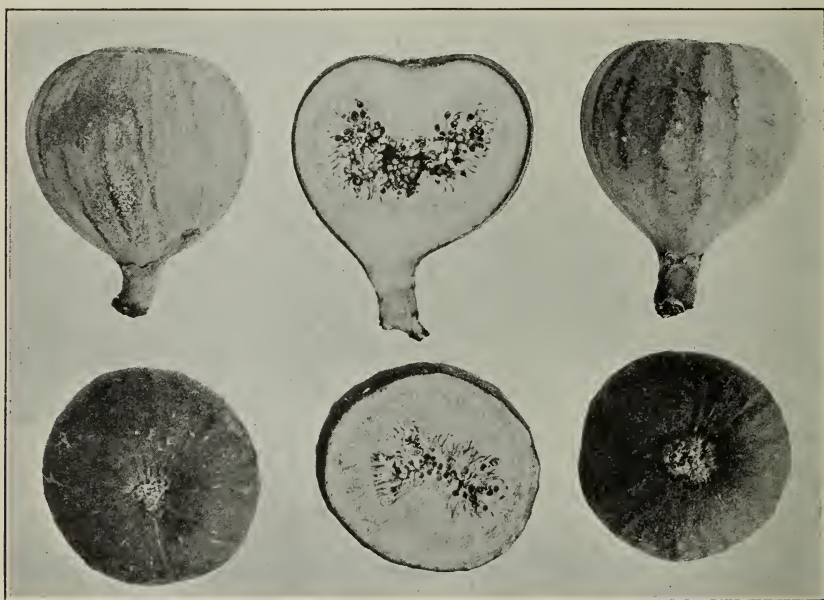


Fig. 4.—The Milco is a standard variety of caprifig throughout the state, although too late to be satisfactory in some sections. Large trees are especially common in Stanislaus County.

unless inhabited by the fig insect; or they may be common figs which drop because of unsuitable climatic conditions. The presence of the larvae of the fig wasp in the gall flowers of the capri fig is just as essential to making that fruit remain on the tree as the caprification of the Smyrna fig is necessary to make it develop. The dropping of Smyrna figs can only be corrected by caprification at the proper time. The dropping of caprifigs can only be prevented by colonizing the figs at the proper time with the fig wasp. The dropping of figs on account of climatic conditions can not usually be remedied and varieties more suited to the conditions should be substituted by replanting or topworking.

CROPS OF THE CAPRIFIG TREE

There are generally recognized three distinct crops of the caprifig tree: the spring or *profichi* crop, the summer or *mammoni* crop, and the winter or *mamme* crop. In the Imperial Valley of California there



Fig. 5.—Caprifig trees often reach a large size and bear very large crops. The picking of figs from such trees is difficult and expensive, however, and smaller, more spreading trees are desirable. The picking scene shown here was taken at the Markarian Fig Gardens, Fresno, 1917.

are said to be seven generations of the fig wasp developing in as many crops of the caprifig, *Ficus pseudocarica*.²

The profichi crop.—The figs of the profichi crop push out on the wood of the previous season's growth (sometimes on still older wood) about the same time the leaves are appearing on the new growth, which is usually the latter part of March or the first of April. The number of profichi figs borne by some trees is almost incredible, often totaling considerably more than the leaves on the tree at the same time. A single Stanford tree has been known to bear 15,000 to 20,000 profichi figs and a single Roeding No. 1 tree from 12,000 to 15,000 figs.

The dates of the appearance of the profichi figs in the spring do not differ materially in the coast and valley districts. The dates of maturity of the profichi figs differ considerably, however, due to the climatic differences existing in the various districts. At Fresno the warm days and nights hasten the development of the fruit and the larvae in the galls so that full maturity is reached about the second week in June, or about 70 days after the figs were entered by the fig wasp. In the San Francisco Bay region the cool days and nights and the fogs retard the development of the fruit so that full maturity is not reached until the middle of August or even the first of September. These differences in the time of maturity of the profichi figs make it possible and practicable to ship them from an early section to a later and vice versa.

The profichi figs normally contain a large number of gall flowers within the receptacle and a mass of male or staminate flowers near the eye. Actual counts (tabulated elsewhere) of the numbers of gall flowers and stamens in different varieties show as many as 1350 gall flowers and 220 stamens in some and as few as 169 galls and 39 stamens in others. The proportion of gall flowers to stamens varies considerably, being 2 to 1 in some specimens and 10 to 1 in others. The proportion of 7 or 8 to 1 is probably a normal one and sufficient as far as stamens are concerned if the pollen is abundant.

The sizes of the individual profichi figs of different varieties vary considerably. They may or may not be uniform in size on the same tree. A fig less than one inch in diameter may be considered small; one two inches or more in diameter is large. Large figs are, as a rule, more desirable than small ones, but large size should be accompanied by other desirable characteristics to make a variety of commercial value.

The profichi figs on the tree in May or June may be of two kinds depending upon the presence of the larvae in the gall flowers. The

² See Pacific Rural Press, March 4, 1916, and August 12, 1916.

figs which are inhabited by insects which develop normally, and keep green and plump until maturity, are designated as *insectiferous* figs. Those which are not inhabited by insects, and which ripen prematurely, turn yellow and drop, are designated as *polleniferous* figs. Varieties of caprifigs which consistently bear quantities of polleniferous figs year after year should be discarded as such figs are of no value whatever in caprification, even though they produce pollen

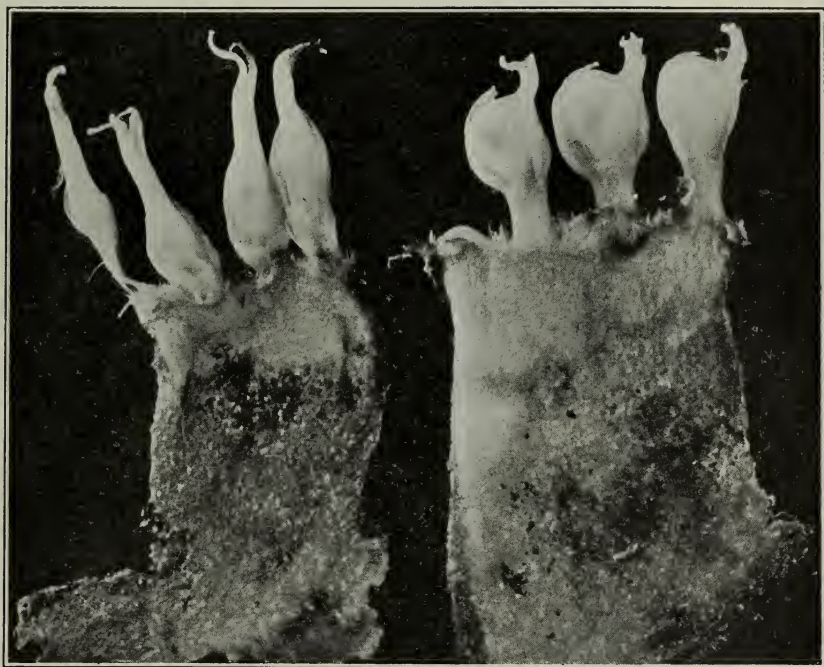


Fig. 6.—Short and long styled fig flowers contrasted. Enlarged five times.

abundantly. Proliferation, which manifests itself in malformed specimens with a mass of stamens protruding through the eye, is common, especially in polleniferous figs. It may be a variety characteristic or simply a seasonal occurrence.

During the period of development the insectiferous figs can be distinguished from the polleniferous figs by their appearance. The former are bluish-green or dark green in color, firm, and plump; the latter are yellowish-green, more or less ribbed and inclined to be soft or spongy. When nearing maturity the insectiferous figs assume a lighter green color and soften perceptibly. The scales at the eye spread apart and leave a distinct opening into the fig; eventually the scales become stiff and more or less erect.

The pollen, which is usually borne in profusion by the stamens, matures just previous to the time the fig wasps are ready to leave the fruit. The relative abundance or scarcity of the pollen produced by a capri fig can be easily gauged by breaking the fig open and shaking it over the open palm. When first dusted out the pollen appears yellowish-white; after a few hours' drying the color changes to an orange-yellow. The pollen grains are fairly uniform in size, are

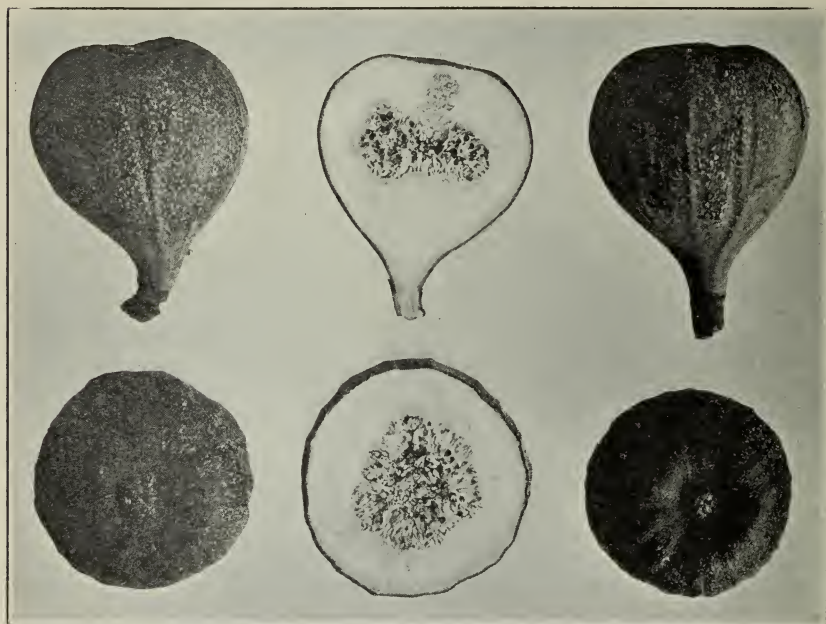


Fig. 7.—Roeding No. 3 is the earliest variety of caprifig grown commercially in California. The profichi figs are large and well supplied with insects and pollen.

spherical or slightly oval, and do not show any distinct or characteristic surface markings.

The texture of profichi figs varies somewhat in different varieties. Some have a thick pithy meat or rind which contains considerable moisture and resists drying. Such figs, known by some growers as "wet figs," are favored, since they presumably enable the insects to issue over a longer period after the figs are placed in the baskets. Markarian No. 2 and Roeding No. 3 are of this nature. Other figs are known as "dry figs," since the meat is thin and dry, Roeding No. 1 and No. 2 and *Pseudocarica* being typical examples.



Fig. 8.—Mamoni or summer crop caprifigs.

The mammoni crop.—The figs of the mammoni crop appear singly or doubly in the axils of leaves on wood of the current season's growth. The dates of their appearance and abundance vary considerably in the different varieties. On trees of the Milco at Fresno the mammoni



Fig. 9.—Staminate caprifig flowers. Enlarged ten times.

figs appeared in numbers a week or ten days before the profichi figs on the same tree were mature. On trees of other varieties the mammoni figs may not appear until practically all the fig wasps have issued from the profichi figs. Some varieties such as Roeding No. 2 bear very few if any mammoni figs.

The figs of the mammoni crop are small in size and few in number compared to the figs of the profichi crop. It is only in the mammoni

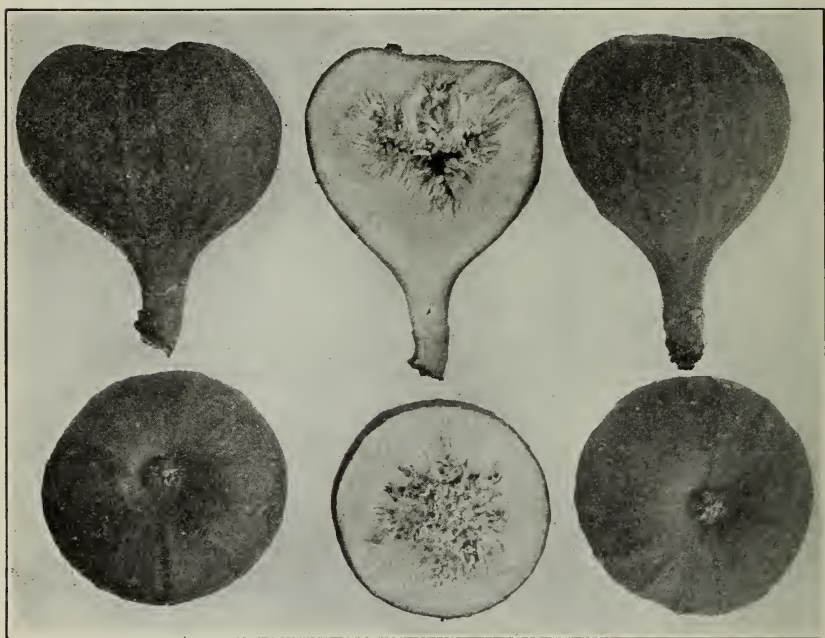


Fig. 10.—Markarian No. 2 from Markarian Fig Gardens, June, 1919. This caprifig is an early variety with large profichi figs. Trees are not common and the variety has not been widely tested.

crop that fertile seeds are commonly found in caprifigs. These result from pollination by the pollen-carrying *Blastophagas* of the preceding crop and from the fact that either the female *Blastophagas* did not oviposit in the seed-bearing flowers or the eggs failed to develop if deposited. The gall flowers of the mammoni fig are undoubtedly pollinated while the female *Blastophaga* is engaged in depositing a single egg in each flower. The ovules or embryo seeds start to develop but in most cases are consumed by the growing larvae. The planting of seeds from mammoni figs can not be expected to produce markedly different results from the planting of seeds of Smyrna figs. B. Longo has shown this to be true by experimental work in Italy between

1911 and 1917. G. P. Rixford also reports the planting of such seeds at Chico, California.³

Many of the mammoni figs which are not inhabited at all or only by a few larvae become, at maturity, pulpy and edible. The mammoni figs of the Milco especially are large, brown, and pulpy.

The mammoni figs in the Fresno district reach maturity during September and October and the issuing *Blastophagas* enter the small



Fig. 11.—Samson (Markarian No. 1) is an excellent variety of caprifig except for the blemish shown in Fig. 12. Trees are widely distributed both in the San Joaquin and Sacramento valleys.

caprifigs which appear scatteringly during the same season. The cooler weather of October and November retards the development of the figs so that the larvae inside and many of the mammoni figs remain on the tree during the winter season, the insects hibernating in the larval state.

Stamens, bearing pollen, are not uncommonly found in the mammoni figs of some varieties.

The mamme crop.—The term *mamme* is almost universally used to designate the crop of caprifigs which remains on the tree during

³ Atti della Reale Accademia dei Lincei, Series 5, Vol. 27, fasc. 1, 1918. B. Longo.

Bulletin 732, United States Department of Agriculture, 1918, pp. 15, 16. G. P. Rixford.

the winter season. The crop is rather commonly known in the San Joaquin Valley as "carry over." *Only those figs which are inhabited by Blastophagas remain on the tree.* The presence of the immature *Blastophagas* in the mamme fig is just as essential to its proper development on the tree as is the presence of the fertile seed in the Smyrna fig to make it set and develop.

The mamme figs appear in the same manner and position as the mammoni figs, but later in the season. As with the other crops the

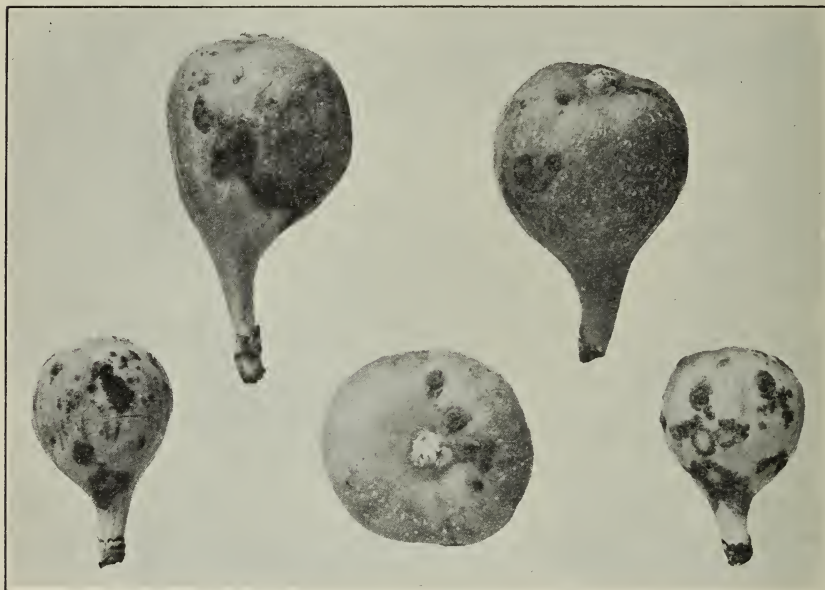


Fig. 12.—This peculiar spot or blemish is a characteristic of some of the profichi figs of the Samson (Markarian No. 1). It is found on all trees of the variety and is evidently distributed by cuttings.

number and size of the mamme figs vary considerably in the different varieties. Roeding No. 2 carries practically no winter crop and therefore, unless reinfested in April from trees of other varieties, fails to set the profichi crop. The Milco and Stanford are generally regarded as varieties which are as certain to "carry over" as any others. In fact isolated trees of both varieties are commonly found which are known to have harbored the *Blastophaga* unaided through a long series of years.

Stamens are commonly found in the ordinary varieties of capri figs during the winter. As many as 110 staminate flowers with well-developed anthers have been counted in a single overwintering Milco fig. It is doubtful whether the anthers of such figs produce mature pol-

len which can be of any value in pollinating breba Smyrna figs. Occasional overwintering specimens with viable pollen may be found in April, but so rarely as to be of little practical consequence. Whether these stamen-bearing winter figs are called belated mammoni or mamme is immaterial as both kinds carry the *Blastophaga* over until



Fig. 13.—The female *Blastophaga* enlarged twenty-seven times.

spring. As previously stated, the caprifig known as *Pseudocarica* bears numerous stamens in the figs of the mamme crop and in the Imperial Valley produces sufficient pollen to be of value in caprifying breba figs. So far in the San Joaquin Valley the *Pseudocarica* has been of no value in this respect, either on account of lack of pollen or failure to develop at the right season.

Since mamme figs remain on the tree during the winter they are subject to injury or total destruction by frost. No definite temperature limit can be set as indicating freedom from frost damage, since conditions other than temperature, such as humidity, enter into the consideration.

Although various methods of storing mamme figs indoors, either loose or attached to twigs, can be used in order to avoid frost damage during winter the necessity for such storage is usually slight, except in the most exposed and frosty situations where successful Smyrna fig culture is problematical.

LIFE HISTORY AND HABITS OF THE FIG WASP, *BLASTOPHAGA GROSSORUM*

The life history of the *Blastophaga* is simple. As just explained the insects pass the winter inside the mamme figs in the larval stage. During the warmer weather of early spring their development is

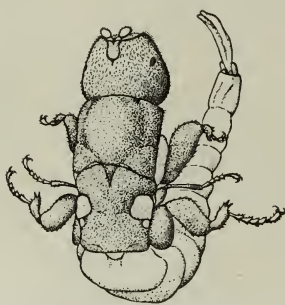


Fig. 14.—The male *Blastophaga* enlarged twenty-seven times.

hastened, they pass into the pupal or resting stage, and about the first of April the adults emerge. The male being the first to issue from the gall flower, immediately begins crawling over the surface of the flowers, gnaws an opening through a thin translucent membrane found just beneath the style, and impregnates the female while she is still inside the gall. The males are wingless and may or may not crawl out of the fig, although it is probable the larger proportion remain inside and perish. The females push their way out of the opening in the gall made by the male and then issue through the eye of the fig, the scales of which open up and usually stand erect when the caprifig becomes mature. The winged females then crawl over the surface of leaves and fruit or make short flights among the branches. On windy days they may be carried several miles away from the trees.

As a rule the first of the profichi figs are ready to caprify before any insects issue from the mamme figs. If a grower wishes to insure the setting of these first profichi figs he may have mamme figs shipped in from an earlier section. Development may also be hastened by placing bundles of branches containing mamme figs in tubs of water set in a greenhouse.

The females which enter the profichi figs deposit an egg in each of numerous gall flowers and die after becoming exhausted. The insectiferous profichi figs then develop gradually until about the first week in June or later, according to the temperature. From the profichi figs the females pass into the mammoni and then into the mamme figs.

The number of eggs deposited by each female is not definitely known, but is probably several dozen. The duration of the egg stage

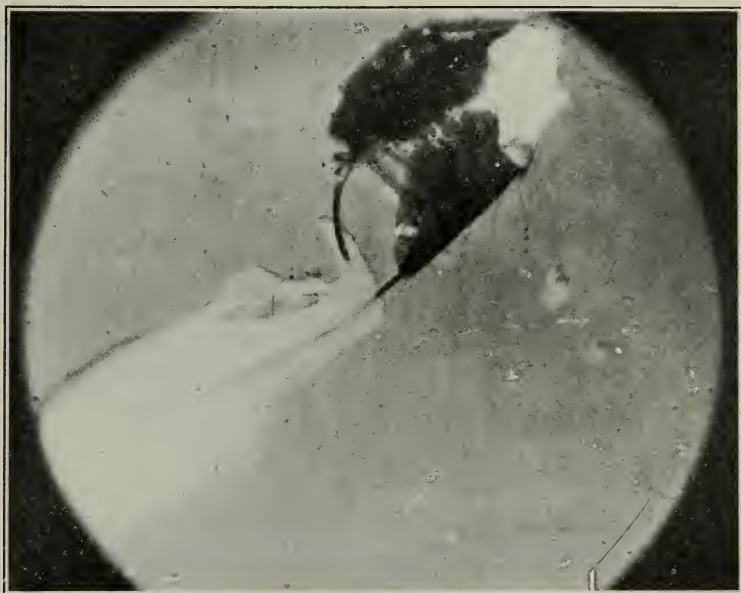


Fig. 15.—*Blastophaga* in act of oviposition. Dark ovipositor can be seen through translucent style. Photo-micrograph. Greatly enlarged.

is not definitely known, but the larval stage in the profichi crop lasts about sixty days. The female may remain alive over night inside the fig; in the sun and wind of orchard atmosphere she seldom lives more than four or five hours.

The time and rate of issuance of the females depends upon the temperature. On clear warm mornings they may begin to issue as early as seven o'clock, in which case they will stop coming out by noon if the heat continues. On cooler mornings the females may not issue freely until eight or even nine o'clock and then continue to issue during the early hours of the afternoon.

The habits and actions of the female *Blastophaga* are exceedingly interesting. When the insects first issue from the eye of the caprifig,

the wings, antennae, legs, and even the glossy part of the thorax, head, and abdomen are dusted thickly with pollen. The females attempt to clean off this excess pollen by stroking the body and wings with the front and hind pairs of legs. The wings are at first horizontal, but very soon take their natural, vertical position, both from their natural tendency to do so and the efforts of the insect by a fanning process which straightens them out and dusts them of excess pollen.

In entering small figs the female wedges the head underneath the edge of a scale at the eye and then gradually pushes her body forward, using her two rear legs as levers. The struggles of the insect

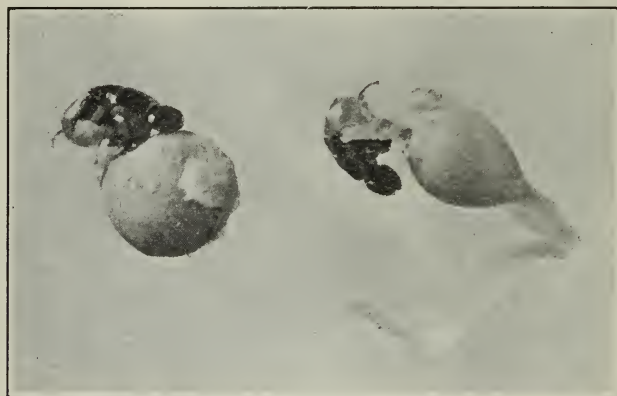


Fig. 16.—Right, male *Blastophaga* emerging from gall. Left, male impregnating female inside gall.

generally result in detaching the wings from her body and these are left protruding from the edge of the scale as mute evidence that the female has gained entrance. The entrance of one insect seems to pave the way for more. It is not at all uncommon to find mammoni figs with five or six females, either around the eye or trying to force an entrance. If such figs are opened, the spaces between the scales are literally packed full and black with the living and dead bodies of *Blastophaga*.

When ovipositing within the small caprifigs the female is not at all disturbed at being observed under a lens. She crawls around over the surface of the flowers evidently feeling her way with her ovipositor. When it is in a favorable position or when the tip enters an open stigma, the female stops, forces the ovipositor into the hollow style, and then becomes passive during the act of oviposition, which lasts from 45 to 55 seconds. The actions of the females inside the

Smyrna figs are very similar to that inside the caprifigs, except that inasmuch as the long-styled flowers of the former are not adapted to oviposition, the insects finally become exhausted and perish.

PRACTICAL POINTS IN CAPRIFICATION

Smyrna figs are in a receptive state during a period of several days. The female *Blastophagas* can enter when the figs are less than three-eighths of an inch in diameter; the flowers of such figs are



Fig. 17.—Female *Blastophaga* emerging from gall after impregnation.

presumably receptive to pollen. From that stage until the figs reach about an inch in diameter they may be entered by insects and caprifigged. After a certain limit of size and length of time without caprification, however, the stigmas wither and turn brown, the fig becomes yellow and eventually drops off. Growers should therefore make previous arrangements for a supply of caprifigs and begin to caprify when the Smyrna figs reach three-eighths to one-half inch in diameter.

The length of the season for caprification naturally depends upon the appearance of the Smyrna figs and the available supply of caprifigs. As a general rule, caprifigs should be distributed every three or four days over a period of three weeks. As already pointed out, insects will issue with a rush from some “dry” varieties while they will continue issuing for several days from “wet” varieties.

Smyrna fig trees are sometimes caprifigged during the third season of growth, although very few figs can be expected until the fourth season. The size of the tree is then a better indication of the number of caprifigs required than is the age, since trees of the same age vary considerably in size. It is difficult to give very definite directions as to the numbers of caprifigs to apply since varieties differ in their effectiveness. Growers generally apply all the caprifigs they can get

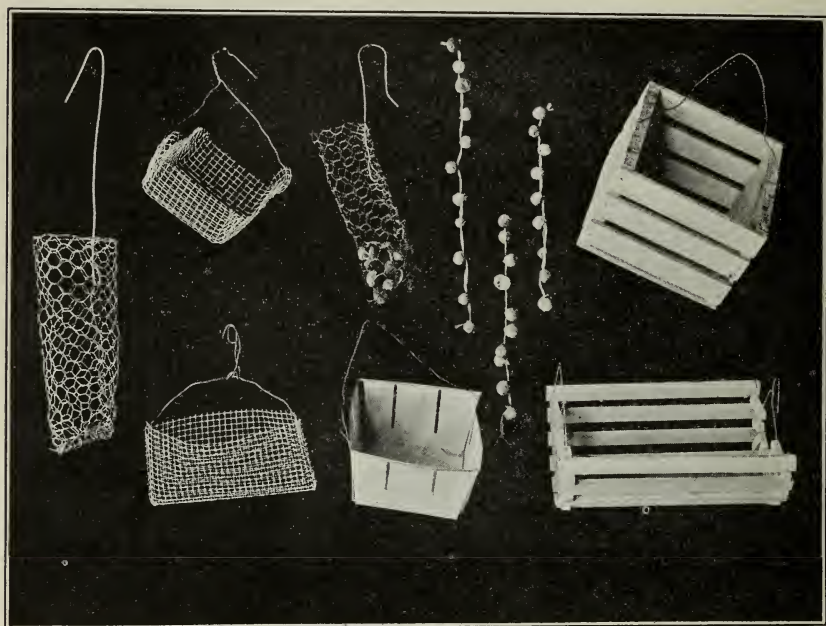


Fig. 18.—The various forms of containers for profichi figs are here shown. The wire-netting baskets are practically indestructible and are most commonly used. Wooden containers have been utilized by a few growers in the Reedley district.

or have available at the time. As a guide to practical caprifigation the following graphic representation may be of assistance (fig. 19).

This estimate of the required number of caprifigs is based on the assumption that fairly large figs well filled with insects and pollen are used, otherwise the number should be materially increased.

Picking caprifigs.—Caprifigs are ready to pick as soon as the male insects begin to issue freely from the gall flowers. This stage of the caprifig can soon be learned by opening a few figs from which insects are issuing and by studying the exterior appearance of the fruit. Indications of maturity are the change in color from green to yellowish-green, the increased size of the opening at the eye, and a slightly soft

feeling when pressed between the fingers. While caprifigs picked somewhat green may mature and allow insects to issue, there is danger in picking the figs too green as the insects may not issue at all or only poorly, or if they do issue freely, the pollen may not mature properly. *The female Blastophaga is absolutely of no value in caprification unless dusted with viable pollen.*

Since the female *Blastophagas* do not issue freely after 2 or 3 p.m., the common practice is to pick caprifigs from that time on until dark. The figs are then stored over night in lug boxes in a cool place and distributed early the following morning. Some growers prefer to pick from daylight until about 9 a.m., the figs being distributed during the same period by a second set of workmen. Some pickers use a picking bag, into which the figs are dropped. The more common practice, however, is to rub the mature figs from the branches, and allow them to fall to the ground, from which they are gathered in boxes. The use of a hooked wire to pull branches within reach is of advantage in picking. The caprifigs should not be allowed to remain on the ground exposed to the sun, as a half-hour's exposure may injure or even kill the insects within.

Pickers of caprifigs soon learn the necessity for protecting their hands and arms while working on account of the irritation caused by the rough leaves and the acrid juice of the fruit.

Shipping caprifigs.—The shipping of caprifigs picked during the day so that they will reach their destination early the following morning, is perfectly practicable. Figs intended for shipping distances requiring more than an over-night trip should be picked more carefully and more immature, otherwise there will be a large number of the insects lost before the figs are placed in the trees. Full dependence upon caprifigs shipped from a distance is hazardous and an outside supply should be used only to supplement the local crop. Growers in some districts make a practice of securing a supply of profichi figs from an earlier section in order to insure the caprification of the first Smyrna figs on the trees. The figs can be shipped in any common fruit box, perforated cardboard cartons being used for small lots, and peach, apple, or orange boxes for larger shipments.

Containers for caprifigs.—The earliest method used in California to distribute caprifigs was to string the figs on pieces of raffia and hang them over a limb or toss them into the upper part of the tree. This method was not only laborious but objectionable to the workmen on account of the irritation of the fingers caused by the acrid milky juice. Various containers have come into common use, these varying

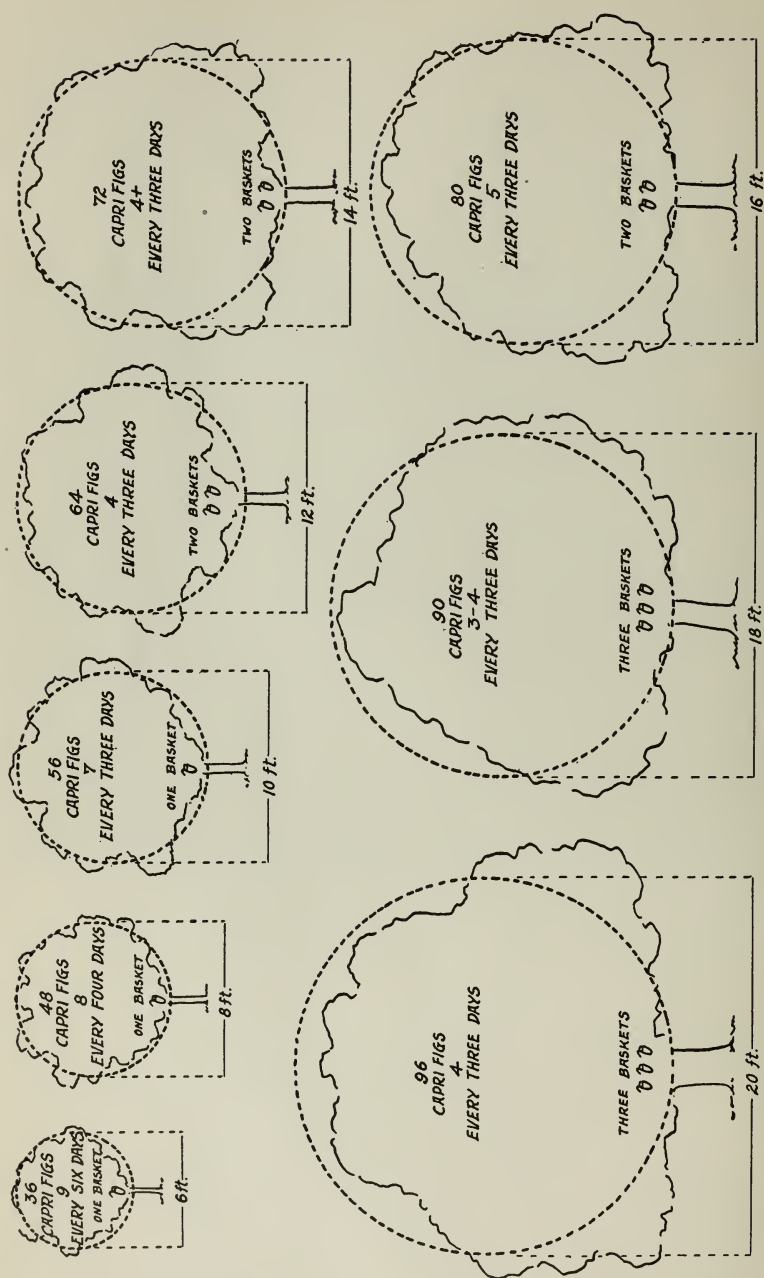


Fig. 19.—The best and most economical method of distribution. In each case the second figure represents the number to be placed in each basket at each caprification.

from strawberry and other fruit baskets to wire or wooden baskets, as illustrated. Since the galvanized wire baskets are practically indestructible, their use is fast increasing. One type of round basket is made of $\frac{1}{2}$ -inch poultry-wire netting, four to six inches in diameter and about ten inches deep, with a wire hooked at the top extending down one side. Another type is made of $\frac{1}{4}$ -inch mesh screening cut into 12-inch squares and pressed out with a plunger into baskets six inches square and three inches deep with a piece of bent wire for a handle.

Planting caprifig trees.—It is now generally conceded by growers that for every one hundred Smyrna fig trees planted, there should also be planted from three to five caprifig trees, the number depending upon the variety. The caprifig trees have been commonly planted on the corner or side of the orchard toward the prevailing wind, a logical practice since *Blastophagas* issuing from unharvested caprifigs will be blown into the orchard by the air currents. Theoretically all caprifigs should be picked and distributed by hand as fast as they mature, but in practice thousands of insects often issue and are lost unless carried to a fig tree by the wind.

The grouping of caprifig trees around farm buildings insures some protection to the mamme crop, and moreover the trees are as ornamental and provide as much shelter and shade as an umbrella tree or other deciduous tree.

Some growers have advocated and practiced the interplanting of caprifig and Smyrna fig trees or the planting of a single or double row of caprifigs through the middle of the orchard, thus expecting to eliminate considerable of the hand distribution. This is open to the objection that irregular results in caprification will be obtained, some trees being over-caprifigged and some under-caprifigged. Furthermore, caprifig trees differ in their water requirements from the Smyrna fig tree: in May when the Smyrna fig trees are being watered, the caprifig trees should not be watered as irrigation delays the maturity of the crop. During the summer, however, the caprifig trees may be benefited by a light irrigation to help them hold their leaves and mature the summer crop.

Since early caprifigs are especially desirable, the practice of planting the trees in protected coves or on warm, sunny hillsides gives excellent results. The advisability of planting orchards of caprifigs alone to supply the market demand has been much discussed. The growers of Smyrna figs are taking more active steps each year to increase their own supply of caprifigs, although the demand for outside figs may be keen for years to come.

VARIETIES

The varieties of caprifigs introduced from abroad and of those grown from seed are numerous. As with all fruits the list of varieties worthy of commercial consideration has been greatly reduced and plantings are being restricted to five or six tested varieties, with a few of the newer kinds added for trial. It is now generally agreed

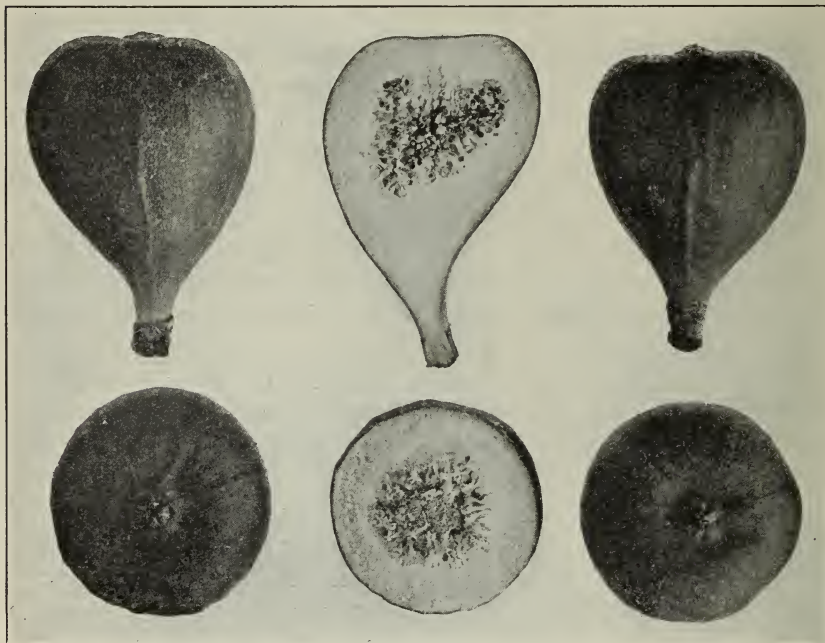


Fig. 20.—Stanford from Markarian Fig Gardens, Fresno. June, 1919. The Stanford is regarded as the best single variety of caprifig in the San Joaquin Valley on account of vigor of growth, succession of crops, and long profichi season.

that the early varieties are most desirable; therefore Roeding No. 3, the earliest commercial variety, and Markarian No. 2 are in demand. For mid-season, Stanford, Roeding No. 1, and Roeding No. 4 are leading in favor. The Milco, being the latest, is planted to finish up the season. Roeding No. 2, Magnissalis and Markarian No. 1 are largely used wherever found. Since growers who have had experience with Roeding No. 3 and Stanford regard them as the two leading varieties and perfectly satisfactory for caprification, it would seem advisable to plant at least 80 per cent of the trees to these varieties. The other 20 per cent can be made up of Milco, which is a sure

carry-over, of Roeding No. 1, and Markarian No. 2 to supplement the early and main crops, and of a few miscellaneous varieties which have been found satisfactory for local conditions.

The efficiency or value of a caprifig variety depends upon the following points:

First, the number of female insects developed from the galls.

Second, the amount of viable pollen produced.

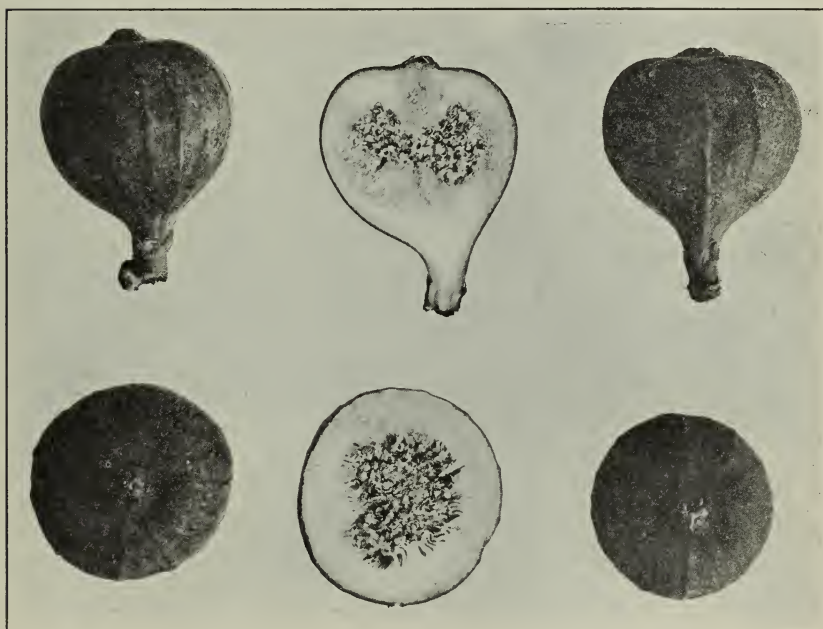


Fig. 21.—Roeding No. 1. No one variety of caprifig is as commonly found in the San Joaquin Valley as this. The trees are very vigorous in growth and have large, deep green foliage. Some growers regard the variety favorably while others are grafting trees over to better varieties.

Third, the season of maturity, both as to time and duration.

Fourth, the abundance of well-developed figs of the profichi crop.

Fifth, the relative abundance and certainty of the mammoni and mamme crops.

Sixth, size of the profichi figs.

Seventh, hardness of the mamme figs.

Eighth, texture of the profichi figs, whether "wet" or "dry."

The following list of varieties includes those which are being planted commercially at the present time, and a few others which are being tested by growers.

Magnissalis.—Profichi figs, large to very large, obovate, prominently ribbed, glossy light green with conspicuous white flecks; meat white with a purplish zone on the inner part; galls and stamens numerous, pollen abundant. Season, medium. Mammoni crop, fair; mamme figs large, purplish in interior. Tree an upright grower, with a general resemblance to trees of the Smyrna type.

Introduced by G. C. Roeding from Asia Minor in 1901 and named after Mr. S. G. Magnissalis of the Herbeyli District.

Markarian (Markarian No. 2).—Profichi figs large to very large, uniform in size and shape, with a few rather prominent ribs; apex smooth; eye depressed;



Fig. 22.—*Ficus pseudocarica*—female fig from Tribble Bros., Elk Grove, September, 1917. *Ficus pseudocarica* like its close relative *Ficus carica* produces both "male" and "female" figs. These edible "female" figs of the *pseudocarica* are small and of no commercial value.

color light green with a few scattered white flecks over the dull surface; neck short, thick, distinct; meat and flower stalks white; galls and stamens numerous; pollen abundant. Season, early. Mammoni crop fair; mamme figs, few. Tree with upright branches. (See fig. 10.)

Introduction and distribution same as Samson (Markarian No. 1). A promising early variety.

A third variety has been grown and distributed by Mr. Markarian under the name Markarian No. 3. This has not yet been thoroughly tested and little is known of its value.

Maslin varieties.⁴—The Maslin varieties of caprifigs originated as seedlings in the E. W. Maslin orchard at Loomis, now leased by the United States Depart-

⁴ See Bulletin 732, United States Department of Agriculture, 1918, pp. 38, 39.

ment of Agriculture. During the past few years the Department has distributed the following for trial: Maslin No. 70 or Bleasdale; No. 144 or Mason; No. 147 or Loomis; No. 148 or Newcastle.

Milco.—Profichi figs medium to large, globular or slightly oblique, smooth; apex rounded; color light bluish-green with fairly conspicuous white flecks; neck very short or missing; meat white with a broad band of violet at the bases of the gall flowers; galls and stamens numerous; pollen abundant. Season late. Mammoni figs numerous; large, pulpy, edible specimens, reddish-brown in color, abundant and conspicuous on the tree. Mamme crop good, certain. Originally



Fig. 23.—Neg. 1445. *Ficus pseudocarica* from male tree on Peabody's place, Santa Barbara, May 21, 1917.

imported from Dalmatia by C. N. Milco. A very good variety where late profichi figs are desired. Large trees especially common in Stanislaus County. (See fig. 4.)

Pseudocarica (*Ficus pseudocarica*).—Profichi figs small to medium, pyriform, with a distinct slender, tapering neck and slender stalk; ribs narrow, fairly prominent except on the apex; eye protruding; surface pubescent, dull; color reddish-brown or even purplish-black in the sun; meat and flowers white; galls and stamens numerous; pollen abundant. Mamme and mammoni figs with pollen-bearing stamens. Planted experimentally as a possible pollinizer of the breba crop of the Smyrna figs. Reported to be a very good caprifig in the Imperial Valley, where seven generations of *Blastophaga* reach maturity, but has not been planted commercially in the San Joaquin Valley. Tree a straggling grower with slender branches; foliage soft and velvety, practically entire. (Figs. 22, 23.)

First introduced by Dr. Franceschi of Santa Barbara from Eritraea and later by the United States Department of Agriculture from Eritraea and Abyssinia.

Roeding No. 1.—Profichi figs medium, short-pyriform, smooth with few ribs; neck distinct, short; apex flattened; eye protruding; color deep green, with inconspicuous white flecks, often reddish brown on the side; meat white with a purplish zone at the bases of the flower stalks; galls and stamens mostly plentiful; pollen abundant. Season, medium. Mammoni figs fairly numerous; mamme crop good. Trees vigorous, spreading, dense, with large foliage; more commonly found in San Joaquin Valley than any other one variety. Introduced by G. C. Roeding, Fresno, from Asia Minor. (See fig. 21.)

Roeding No. 2.—Profichi figs small, round pyriform, with inconspicuous ribs; neck short; apex rounded, eye protruding; surface smooth, glossy, greenish-yellow; meat white with purple zone at bases of the flower stalks; galls fairly plentiful; pollen abundant. Season later than Roeding No. 1. Mammoni and mamme crops practically none, hence a variable profichi crop unless well caprifried from other trees. Trees upright in growth, with rather slender branches and small, sparse foliage. Not generally favored by growers on account of small, dry fruit and absence of summer and winter crops. Introduced by G. C. Roeding with his No. 1.

Roeding No. 3.—Profichi figs large, pyriform, with a short neck; ribs very prominent, extending from the neck to the flattened apex; eye prominent; color green or yellowish-green with the surface conspicuously flecked with white; meat white with deep purple zone at bases of flower stalks; galls numerous; pollen abundant. Season, early. Mammoni figs large, ribbed, fairly numerous; mamme crop usually good, reported to be somewhat tender. Trees of dwarf habit, with slender twigs and small foliage; vigorous in some sections and weak-growing in others. An excellent variety. Introduced by G. C. Roeding with Nos. 1 and 2.

Roeding No. 4.—Profichi figs small to medium, short-pyriform; apex rounded with protruding eye; color dark green; interior purplish; galls and stamens abundant. Season medium to late, long continued. Mammoni and mamme crops good on some trees and poor on others. Trees very similar to and often confused with Roeding No. 2, but more generally favored than the latter variety. Introduced by G. C. Roeding.

Samson (Markarian No. 1).—Profichi figs large, obovate, irregular in shape and size, very dark green with numerous and conspicuous white flecks on the surface; ribs fairly prominent; apex depressed, eye slightly protruding; neck short and thick; inner portion of meat very dark violet-purple, more so than in any other variety so far studied; galls and stamens numerous, pollen abundant. Season, medium. Mammoni crop fair; mamme figs, medium in size, dark purple inside. Tree vigorous, dense, spreading. (See figs. 11, 12.)

Probably introduced by G. P. Rixford with the original importation of Smyrna figs and first planted on the Stanford Ranch at Vina, where the parent tree is still growing a short distance north of the old ranch house. Cuttings and trees widely distributed by H. Samson of Corning. Later obtained by H. Markarian of Fresno and named by him Markarian No. 1. Figs of the profichi crop affected by a peculiar blemish or spot which not only mars the appearance but prevents the figs from developing properly. Here named Samson instead of Markarian No. 1 in order to avoid confusion with the No. 1 variety of Roeding.

Stanford.—Profichi figs oblique-pyriform with distinct, somewhat elongated neck; size irregular but usually above medium; ribs narrow, distinct but hardly conspicuous; surface appearing smooth, somewhat glossy or covered with a bluish bloom; apex rounded; eye protruding; color light to dark green, with or without

white flecks; interior white; galls and stamens numerous; pollen abundant; season medium, long continued. Mammoni and mamme crops abundant, certain. Trees vigorous, dense, spreading, with dark green foliage. Undoubtedly the best single variety for commercial planting. Introduced with the original Smyrna fig cuttings from Asia Minor by G. P. Rixford and distributed by him; one of the large original trees growing on the old Stanford Ranch, Vina. (See fig. 20.)

Miscellaneous varieties:

Howard.—Introduced from Italy and distributed by G. C. Roeding.

Capri E.—Introduced by G. C. Roeding, but history and identity lost. Reported to be a satisfactory and promising variety at Reedley and Orosi.

Van Lennep.—Introduced by D. Van Lennep of Auburn; profichi figs purplish-brown when mature.

TABULATED DATA OF CAPRIFIG VARIETIES

Variety		Average no. of galls	No. counted	Average no. of stamens	Average no. of Blastophaga issuing				Season
					Profichi crop		Mamme crop		
					Females	Males	Females	Males	
Roeding	No. 1	398	10	108	472	34	216	34	Medium
Roeding	No. 2	938	10	98	354	31	244	44	Medium
Roeding	No. 3	1349	7	166	751	41	403	41	Early
Roeding	No. 4	509	10	103	617	32	.....	....	Medium
Samson	(Markarian No. 1)	434	10	233	443	33	.....	....	Medium
Markarian	(No. 2) ..	954	9	188	437	19	.....	....	Early
Milco	.....	635	10	118	389	51	236	35	Late
Stanford	.....	401	10	181	542	27	.....	....	Medium
Maslin	No. 70	903	3	125	.....	....	.....	....	Medium
Maslin	No. 140	1011	5	168	.....	....	.....	....	Medium
Maslin	No. 147	711	3	307	.....	....	.....	....	Medium
	(from Ceres)								
Maslin	No. 147	1048	5	161	.....	....	.....	....	Medium
	(from Loomis)								
Maslin	No. 148	904	5	145	.....	....	.....	....	Medium
Magnissalis	.....		....	.....	449	19	.....	....	Medium

Some of the records shown in the table were obtained from figs placed in glass chimneys covered with a cloth, others from figs enclosed in cloth and paper bags on the tree. As already explained only a small percentage of the males issue, most of them remaining inside among the gall flowers, from which it is difficult to collect them intact.

CAPRIFICATION OF COMMON FIGS

It is now generally recognized that common figs, such as the Adriatic, the Mission, and the Dottato (Kadota) can be caprified as readily as the Smyrna figs. Over a decade ago at least two European writers described more or less in detail the changes occurring in size, shape, color of skin and flesh, and quality, due to caprification of

certain varieties of common figs. G. Celi⁵ concluded that caprifig figs have a greater tendency to split, and further that caprification increases the size of the fruit but injures the quality. Du Sablon⁶ concluded that caprification increases the volume and the weight materially, and the water content slightly, but decreases the sugar content. He believed that on the whole, caprification is advantageous. Both writers studied fresh figs only.

G. P. Rixford in 1918 gave it as his opinion that it would pay anyone planting Mission, Adriatic, or other common varieties of figs to plant also sufficient caprifig trees to caprify the orchard. Tribble Bros.⁷ of Elk Grove also report favorable results in caprifying common figs.

The effects of caprification upon different varieties of figs are so marked that it seems well to note them more or less in detail.

Adriatic.—Exterior appearance only slightly changed by caprification; center of the uncaprified figs hollow, of the caprifig figs solid; color of flesh of uncaprified figs, light strawberry, of the caprifig, deep strawberry-red; flavor of the caprifig figs peculiarly acid. Fertile seeds in eleven caprifig specimens vary in number from 472 to 1288 in number. Caprifig Adriatic figs often retain a greenish color in drying but are noticeably lighter and more attractive in appearance than the uncaprified specimens.

Some experienced growers of the Adriatic fig are positive that caprification causes the fruit to split and increases the amount of infestation by worms. On the other hand, careful records made during the drying season show that the weight of the dried fruit is increased from 10 to 20 per cent. Where the Adriatic fig is grown under the best conditions, that is where the water table is not too high and atmospheric humidity is low, the caprification of the crop is certainly justified, providing caprifigs can be obtained at a reasonable price.

Mission.—The only external evidence of caprification in the Mission fig is the increased size. Internally the color of the flesh is a considerably darker red. The caprifig figs when dried are larger on an average, of better texture, and of richer quality on account of the fertile seeds.

Dottato (Kadota).—Caprification affects the fruit of the Dottato more noticeably than it does most other common figs. The differences may be noted as follows: The color of the uncaprified fig is a light,

⁵ G. Celi. Atti. R. Istituto D'Incorraggiamento Napoli, 6 ser., Vol. 59, pp. 541-654, 1907.

⁶ L. Du Sabon, Rev. Gen. Bot., vol. 20, nos. 232, 233, 1908.

⁷ Tribble Bros. Pacific Rural Press, Jan. 20, 1912, p. 52.

lemon yellow, the surface somewhat glossy; of the caprifig, the color is green or yellowish green and the surface dull. Ribs on uncaprified figs practically absent, on caprifig fruit ribbed appearance marked, especially in the wilted specimens. Meat or rind seemingly little affected in thickness and texture. Color of flesh in uncaprified figs amber or pinkish-amber to light strawberry, in caprifig specimens much deeper. Uncaprified figs, practically seedless, at least seeds small and hardly noticeable; caprifig figs with numerous, large, fertile seeds. Flavor of caprifig figs sweeter and richer.

The value of caprification of the Dottato fig depends upon the ultimate use of the fruit. For fresh-fruit shipping the figs are larger and heavier, but the naturally good shipping quality is somewhat impaired. For drying, the caprifig figs are much superior to the uncaprified, although the skin is still thick and tough. For preserving, the uncaprified figs are much more desirable because they are better in appearance, in size, and in canning quality. Most growers prefer the uncaprified fruit and avoid caprification if possible.

Fertile seeds in Dottato figs were counted as follows: 544, 412, 402, and 667.

ANALYSES OF CAPRIFIED AND UNCAPRIFIED FIGS

Variety	Analysis by	Percent of water	Percent of sugar
Fig d'Or, caprifig	Du Sablon	80	11.2
Fig d'Or, uncaprified	"	74	12.6
Fig Datte, caprifig	"	71	14.3
Fig Datte, uncaprified	"	71	18.7
Bourjassotte, caprifig	"	70	3.5
Bourjassotte, uncaprified	"	76	6.2
Adriatic, caprifig	W. V. Cruess	----	19.05
Adriatic, uncaprified	"	----	18.00
Dottato (Kadota), caprifig	"	----	35.2
Dottato (Kadota), uncaprified	"	----	28.4
Dottato (dried), caprifig	F. W. Albro	22.57	75.36
Dottato (dried), uncaprified	"	25.75	68.16
Adriatic (half dried), caprifig	F. E. Twining	27.05	34.8
Adriatic (half dried), uncaprified	"	28.7	35.5
Adriatic (fresh), uncaprified	M. E. Jaffa	70.70	18.78
Adriatic (fresh), caprifig	"	74.70	13.00
Adriatic (dry), uncaprified	"	18.00	51.50
Adriatic (dry), caprifig	"	16.00	48.50

The figures shown above are somewhat conflicting. In the analyses reported by Du Sablon and Jaffa the uncaprified figs show the highest percentage of sugar; in those made by Cruess and Albro the caprifig figs show the highest sugar content. While the percentages given by

Twining show the uncaprified figs to contain somewhat more sugar than the caprified, tests of individual figs made by him show the caprified fruit to have both the highest and the lowest percentage of sugar, namely 43.1 and 30.6.

ECONOMIC CONSIDERATIONS

The cost of caprification has been estimated^s as “not to exceed 2 cents per tree or from \$1.00 to \$1.50 per acre.” This may have been possible in years long past, but is certainly not possible with the present price of labor. The items which enter into the consideration of costs may be enumerated as follows: containers, picking the capri figs, cartage, distribution in the orchard, producing value of land devoted to caprifig trees, occasional mamme figs to recolonize trees or additional profichi figs to supplement the grower's own crop.

The cost of containers will vary from a few cents up to ten cents each, depending upon the kind used. Since the first cost of the wire baskets is low, from \$3.00 to \$10.00 per acre depending upon the use of one, two or three baskets per tree, such containers are most economical in the end.

It is difficult to give any figures on the cost of picking caprifigs on account of the great differences in pickers, trees, varieties, and amount of mature fruit on the tree at one time. For purposes of making estimates, however, it can be stated that one man can harvest from the tree and ground about 500 caprifigs per hour. Two or more men usually work together, one being engaged to gather the figs from the ground in order to avoid injury from the sun. There may or may not be an item for cartage since this depends on the location of the caprifig trees.

The caprifigs can be distributed in the orchard somewhat more rapidly than they can be picked, possibly one-half again as fast. The rapidity of distribution depends upon the size of trees, number of baskets in each tree, spacing of the trees, and their branching habit. If the boxes of caprifigs are placed at convenient points in the orchard, a good workman should distribute from 500 to 750 figs per hour.

The caprifig tree is in itself not productive of a marketable food crop. The crop has a commercial value and many trees are more remunerative than other fig trees producing edible figs. In general, however, it can be said that caprifig trees are maintained in the orchard simply to make it possible for the remaining trees to produce a commercial crop. The productive value of the space occupied by

^s Bulletin 732, United States Department of Agriculture, 1918, p. 19.

the caprifig trees, therefore, must be taken into account when comparing the cost of producing Smyrna figs with that of other varieties which do not require caprification.

It is frequently necessary for growers to recolonize caprifig trees in April following a cold winter or to purchase early mamme figs to insure an early setting of the profichi crop. Since mamme figs of good varieties are known to contain several hundred female *Blastophagas* each, the number required to produce a good setting of profichi figs is not large. The insects from one mamme fig should make several score of profichi figs set. Higher prices for a few mamme figs are therefore more justified than for the large number of profichi figs required. The prevailing price during the past three years in the San Joaquin Valley has been five cents for each mamme fig.

Growers of Smyrna figs are fast learning the advisability of planting enough caprifig trees of good varieties to provide for the caprification of their own orchard. It is often necessary, however, to purchase additional profichi figs from neighbors or from distant growers. For example, in 1918 one district alone obtained from other counties 259,000 caprifigs at a total cost of \$1807.⁹ Owners of an individual or of a few caprifig trees are accustomed to contract the crop to Smyrna fig growers at from \$5.00 to as high as \$50.00 per tree, depending upon the size of the tree and its crop. In case the figs are sold in small lots they are quoted at \$1.50 per hundred, or even higher for smaller quantities than one hundred. In larger quantities profichi figs bring from \$6.00 to \$10.00 per thousand. Since some varieties are more efficient than others it would seem justifiable to adopt a sliding scale of prices, quoting a higher price for the larger and finer figs than for the smaller and less efficient ones.

⁹ Itemized as follows:

From Reedley and Fresno:	
76,000 figs @ \$10.00 per M	\$760.00
From U. S. Department of Agriculture, Loomis:	
17,000 figs @ \$3.00 per M	51.00
From Ceres:	
166,000 figs. @ \$6.00 per M	996.00
Total	\$1807.00

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